Python Portion of Homework 1:

Code Section:

This section shows the python code that was used to generate the plots for problems 1 and 2. The code makes use of the matplotlib.pyplot library and the numpy library. The code is annotated to highlight which portions of the code are relevant to each question.

```
import numpy as np
import matplotlib.pyplot as plt

func_axis = np.arange(-100,100)
u = np.heaviside(func_axis,1)
u_p_4 = np.roll(u,-4) #the end wont be plotted so dont care
u_m_5 = np.roll(u,5)
#starting function
x = func_axis*(u_p_4-u_m_5)
x_graph = x[90:111]
plot_axis = np.arange(-10,11)
plt.figure(1)
plt.stem(plot_axis,x_graph,use_line_collection=True)
plt.savefig('test.png')#just for reference
#1a
g1 = np.roll(x_graph,3)
plt.figure(2)
plt.stem(plot_axis,g1,use_line_collection=True)
plt.xlabel("n")
plt.ylabel("g1[n]")
plt.savefig("hw1_1a.png")
#1b
g2 = np.zeros(21,dtype=int)
for i, point in enumerate(g2):
    index = i-10
    g2[i] = x[(2*index-3)+100]
plt.figure(3)
plt.stem(plot_axis,g2,use_line_collection=True)
plt.xlabel("n")
plt.ylabel("g2[n]")
plt.savefig("hw1_1b.png")
#1c
plt.figure(4)
g3 = np.flip(x_graph)
g3 = np.roll(g3,1)
plt.stem(plot_axis,g3,use_line_collection=True)
plt.xlabel("n")
plt.ylabel("g3[n]")
plt.savefig("hw1_1c.png")
#1d
plt.figure(5)
g4 =np.roll(g3,2)
plt.stem(plot_axis,g4,use_line_collection=True)
plt.xlabel("n")
```

```python
plt.ylabel("g4[n]")
plt.savefig("hw1_1d.png")
#1e
g5 = np.zeros(21, dtype=int)
for i, point in enumerate(g5):
    index  = i-10
    if (int(index/2) == float(index)/2):
        g5[i] = x[int(index/2)+100]
plt.figure(6)
plt.stem(plot_axis,g5,use_line_collection=True)
plt.xlabel("n")
plt.ylabel("g5[n]")
plt.savefig("hw1_1e.png")
#1f
delta = np.zeros(21, dtype=int)
delta[10] =1
g6 = x_graph*delta
plt.figure(7)
plt.stem(plot_axis,g6,use_line_collection=True)
plt.xlabel("n")
plt.ylabel("g6[n]")
plt.savefig("hw1_1f.png")


#----------------------------------------------#
#Problem 2A
#----------------------------------------------#
#generate x
x_n = np.zeros(21)
base_x =0.5

for i, value in enumerate(x_n):
    index = i-10
    if(index>=0 and index<=3):
        x_n[i] = np.power(base_x,index)

#generate y
y_n =np.zeros(21)
base_y =0.25
for i, value in enumerate(y_n):
    index = i-10
    if(index>=0 and index<=5):
        y_n[i] = np.power(base_y,index-1)

plt.figure(8)
plt.stem(plot_axis,x_n,use_line_collection=True)
plt.xlabel("n")
plt.ylabel("x[n]")
plt.savefig("hw1_2aX.png")
plt.figure(9)
plt.stem(plot_axis,y_n,use_line_collection=True)
plt.xlabel("n")
```

```
plt.ylabel("y[n]")
plt.savefig("hw1_2aY.png")

#---------------------------------------------#
#Problem 2B
#---------------------------------------------#
z_n = x_n*y_n
plt.figure(10)
plt.stem(plot_axis,z_n, use_line_collection=True)
plt.xlabel("n")
plt.ylabel("z[n]")
plt.savefig("hw1_2b.png")
```

Results:

This section shows the results to each question broken down by parts. Any supplimental questions regarding the plots for each question will also be answered in these subsections.

1A

This section contains the plot for part 1A. The plot is shown in Figure 1.

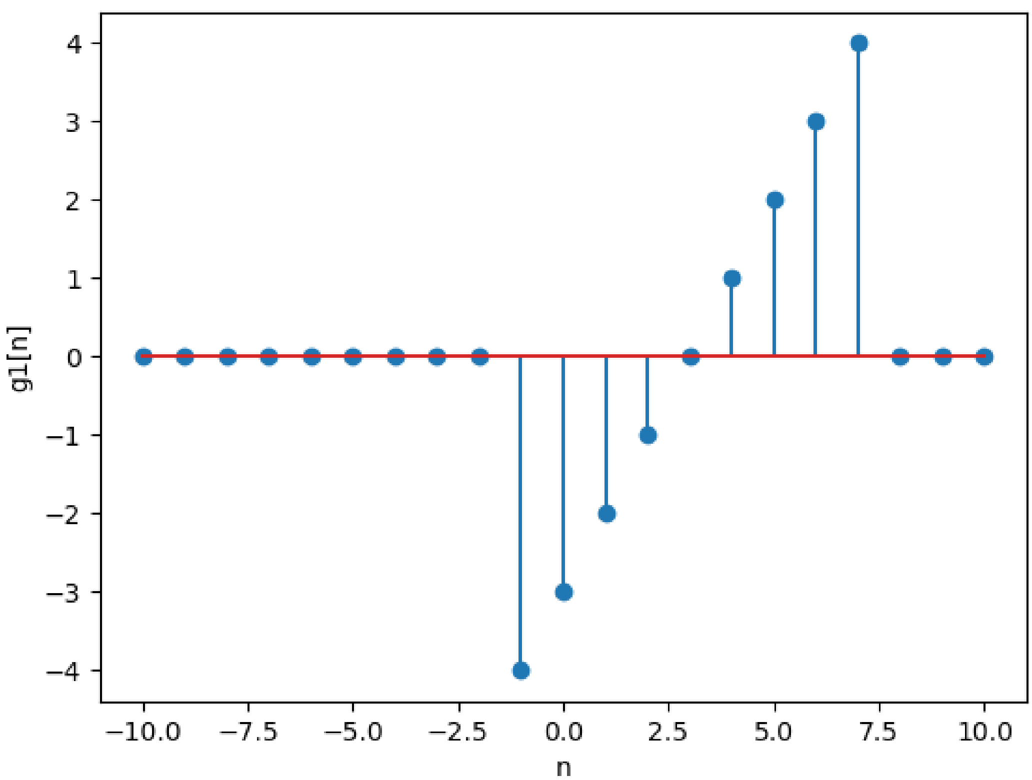

Figure 1: g1[n] = x[n-3]

1B

This section contains the plot for part 1B. The plot is shown in Figure 2.

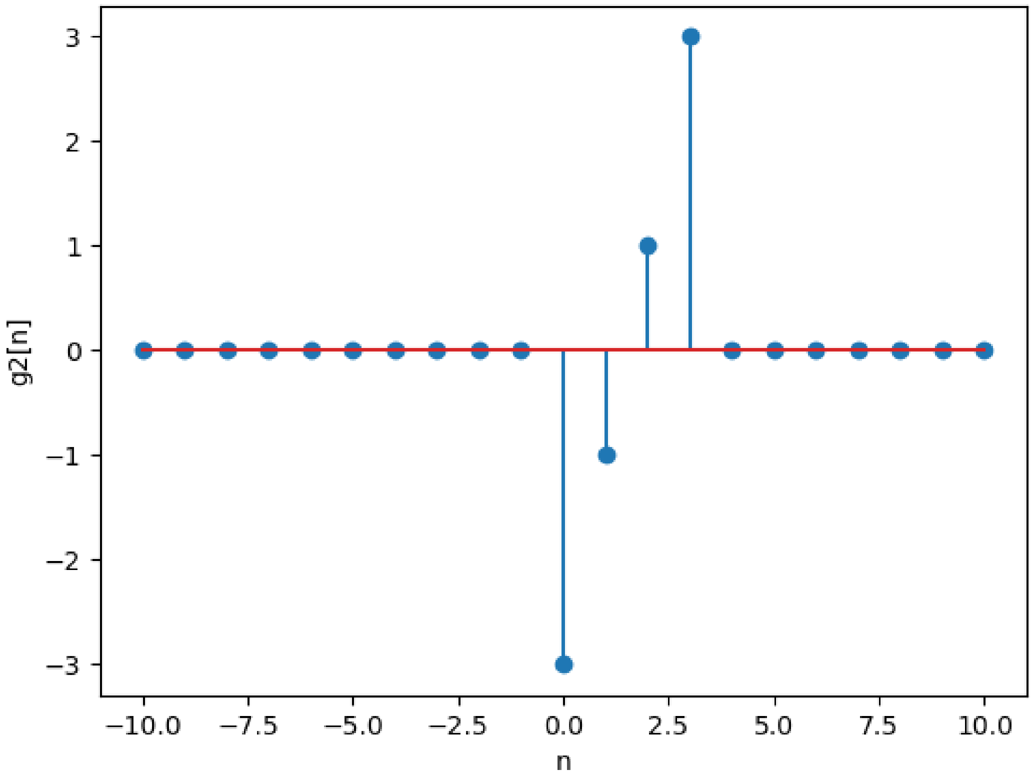

Figure 2: g2[n] = x[2n-3]

1C

This section contains the plot for part 1C. The plot is shown in Figure 3.

1D

This section contains the plot for part 1D. The plot is shown in Figure 4.

1E

This section contains the plot for part 1E. The plot is shown in Figure 5.

1F

This section contains the plot for part 1F. The plot is shown in Figure 6.

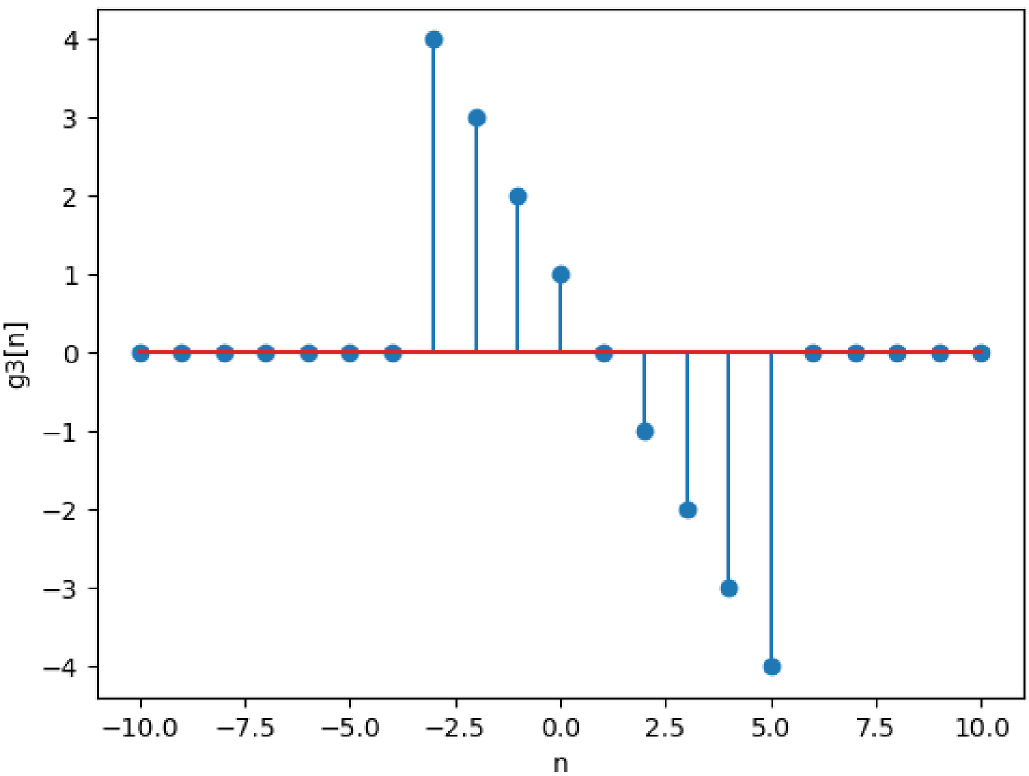

Figure 3: g3[n] = x[-n]

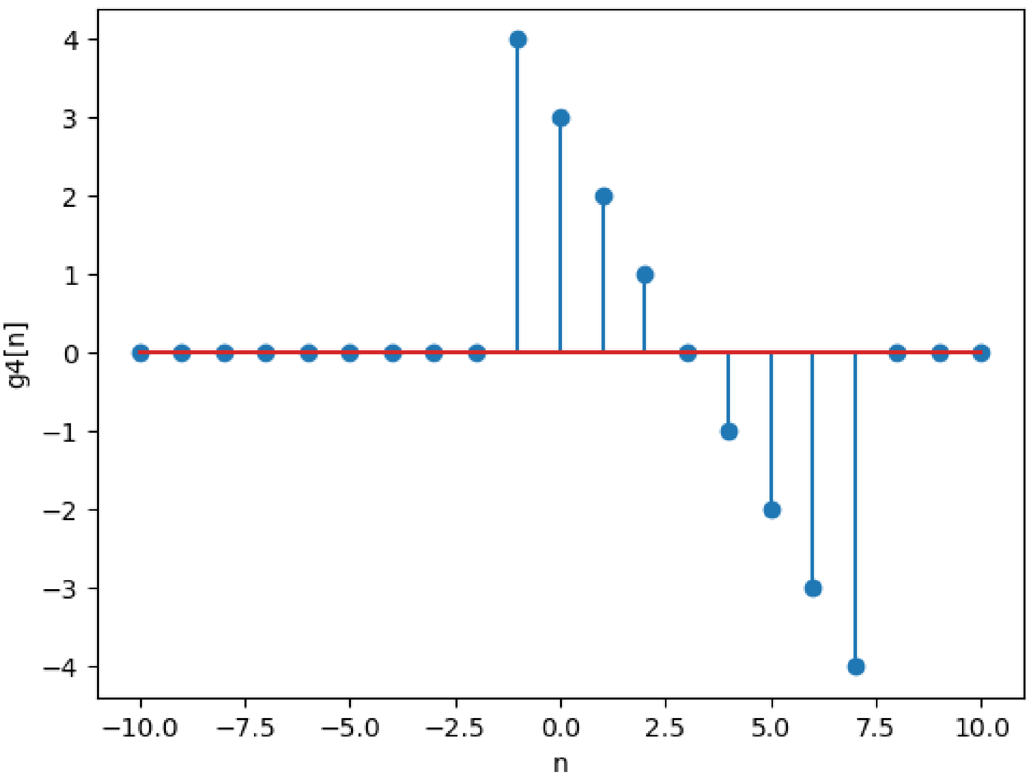

Figure 4: g1[n] = x[2-n]

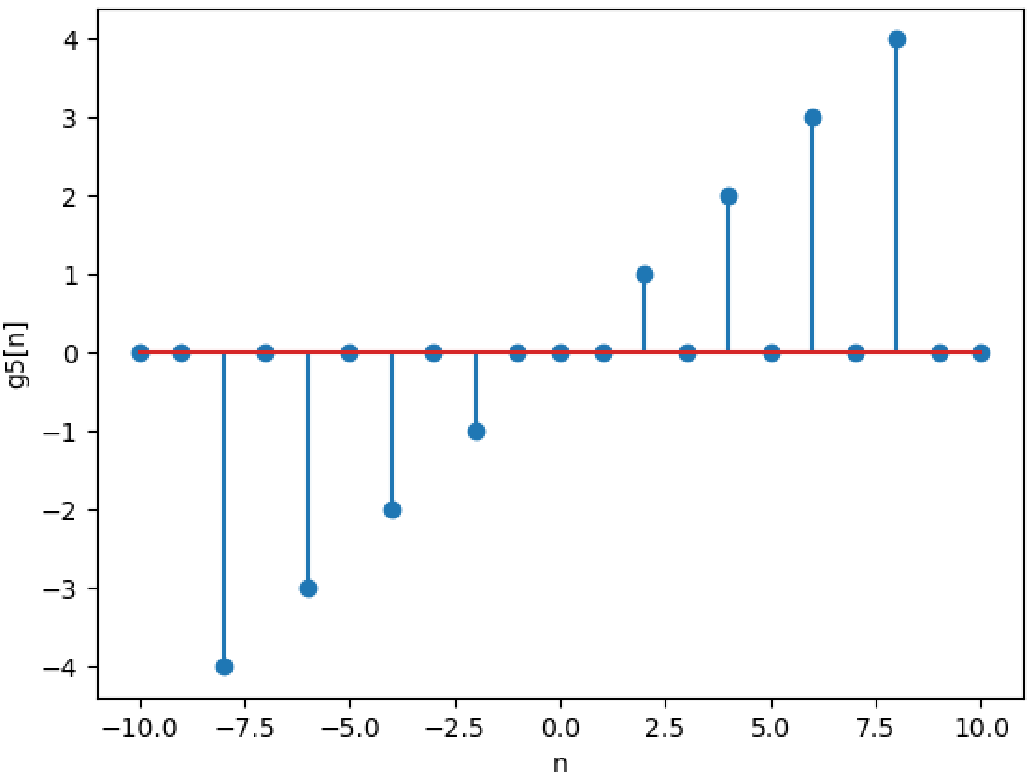

Figure 5: g1[n] = x[n/2]

2A

This section contains the plots for part 2A. The plot of x[n] is shown in Figure 7 and the plot of y[n] is shown in Figure 8. Both functions are decaying exponentials in which are limited to a finite number of points (as if by a pulse function). Because these do not continue indefinitely, we will simply be plotting the values between [-10,10].

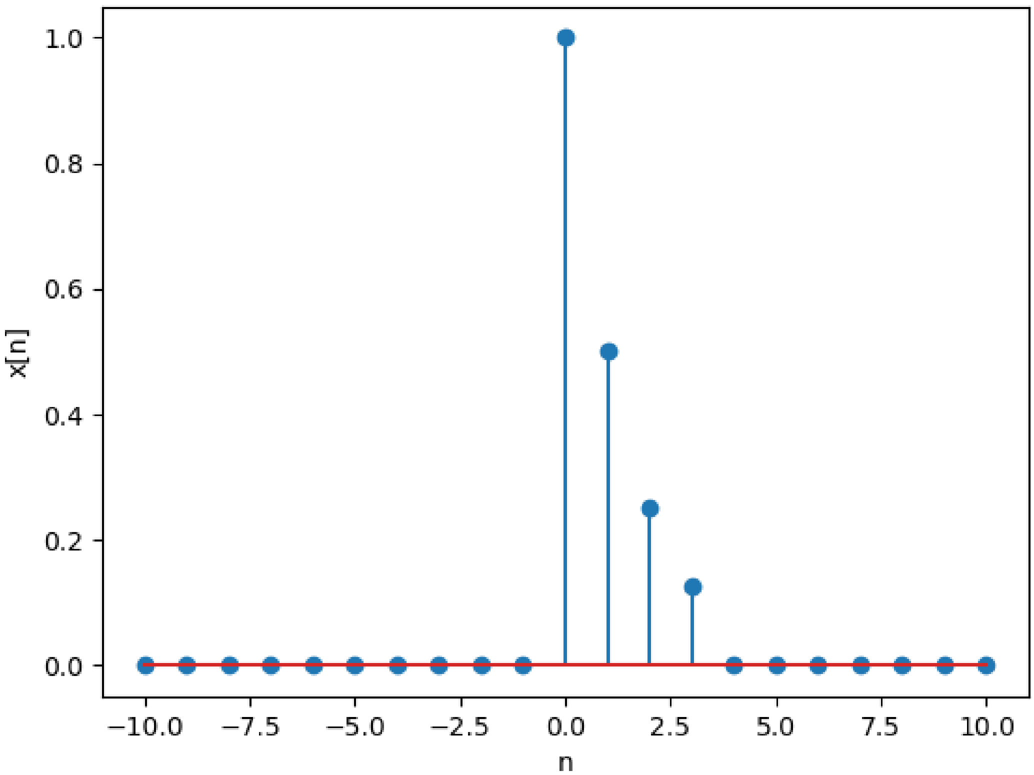

Figure 6: x[n]

2B

This section contains the plots for part 2B. The plot of z[n] = x[n]*y[n]. This plot is obtained through multiplying the two graphs (x[n] and y[n]) by each other sample by sample.

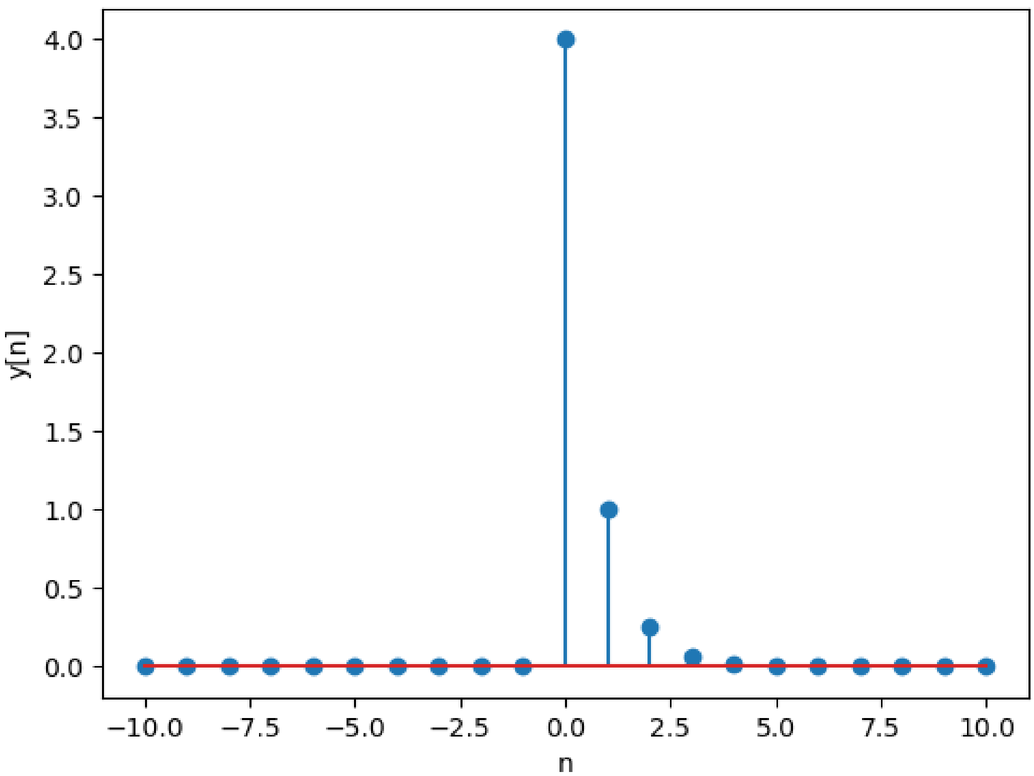

Figure 7: y[n]

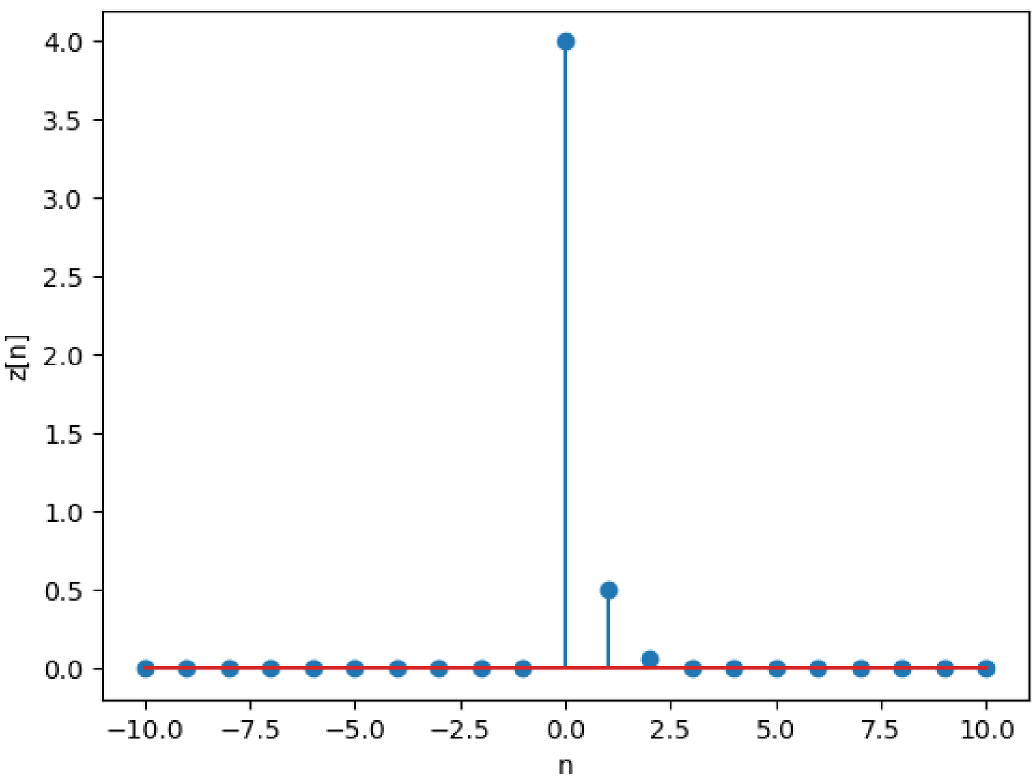

Figure 8: z[n]